

# Chemical characterization of PM<sub>10</sub> and trace gas measurements with the online-system MARGA at the research station Melpitz in Germany

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In this study the new sampling system MARGA (Monitor for Aerosols & Gases in ambient Air, Applikon Analytical, NL, *ten Brink et al., 2007*) was connected to a PM<sub>10</sub> inlet to measure the mass concentrations of the water-soluble ions Cl<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, Na<sup>+</sup>, NH<sub>4</sub><sup>+</sup>, K<sup>+</sup>, Mg<sup>2+</sup>, Ca<sup>2+</sup> and their corresponding trace gases HCl, HNO<sub>2</sub>, SO<sub>2</sub>, HNO<sub>3</sub> and NH<sub>3</sub> at a time resolution of one hour. Measurements were carried out for more than one year (October 2009 – January 2011) at the research station of the Leibniz Institute for Tropospheric Research in Melpitz, Germany (12°56'E, 51°32'N, 86 m a.s.l.). The station is located 50 km north-east of the city of Leipzig near the river Elbe in a flat terrain surrounded by agriculture land without wind obstacles. Melpitz is an urban background site in Europe. Two main wind directions are influencing the station: Wind from the south-west transports maritime air after crossing a large area of Germany. The second main wind direction is east with anthropogenic polluted air masses from eastern Europe (long-range transport, *Spindler et al., 2010*).

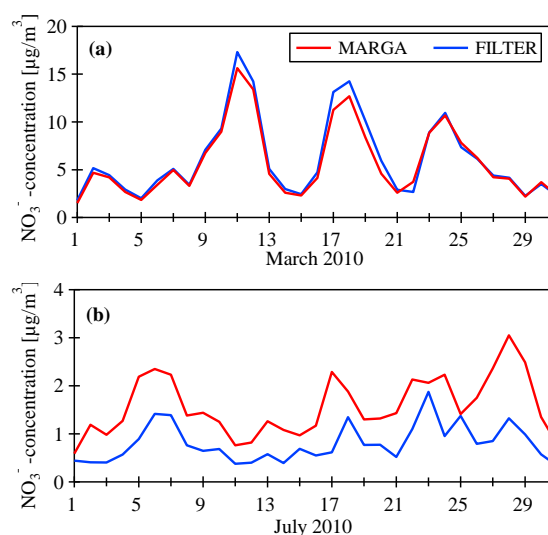
The hourly PM<sub>10</sub> MARGA measurements were analyzed with consideration of the meteorological conditions (relative humidity, temperature and wind direction).

The data set obtained by the MARGA was compared with results of gas monitors (UV-fluorescence for SO<sub>2</sub> and cavity-ring-down spectroscopy for NH<sub>3</sub>) and with daily filter samples (HV-DIGITEL DHA-80 sampler with a PM<sub>10</sub>-inlet and quartz-fibre filter by Munktel, Sweden) to evaluate the new measuring system.

The SO<sub>2</sub> concentration of the MARGA and the gas monitor are in very good agreement. The comparison between the MARGA and a NH<sub>3</sub> gas monitor (Picarro G1103), however, shows significant differences due to a particle filter inside the Picarro system. The filter is needed to guard the measuring cell against particles. But NH<sub>3</sub> can evaporate from the particles collected on this filter due to the volatility of NH<sub>4</sub>NO<sub>3</sub> and generate positive artefacts.

A good agreement was observed for the concentrations of NH<sub>4</sub><sup>+</sup> and SO<sub>4</sub><sup>2-</sup> between filter and MARGA measurements. Discrepancies occurred during the summer month for the nitrate concentration. NO<sub>3</sub><sup>-</sup> measured by the MARGA was on average two times

higher than the concentration determined by the filter-based method in July 2010. Again this artefact of the filter measurements can be explained with the volatility of NH<sub>4</sub>NO<sub>3</sub>. During months with high mean temperatures the corresponding trace gases HNO<sub>3</sub> and NH<sub>3</sub> evaporate from the particle phase collected with the filter. During the winter this artefact is not detected (figure 1).



**Figure 1.** Nitrate measurements in PM<sub>10</sub>. Comparison of daily High-Volume filter measurements (quartz-fibre filter, DIGITEL DHA-80, blue line) with MARGA measurements (red line) in (a) March 2010 and (b) July 2010.

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